SECTION 3. STORMWATER RETROFIT OPPORTUNITIES

Ideally, stormwater treatment practices, which are designed to maintain water quality, control flooding, protect stream channels, or meet other watershed goals, are put in place as development occurs. When sites are designed in this way, a plan can be developed with stormwater management in mind by providing the necessary contours, space, and other features necessary to accommodate these practices. Unfortunately, significant portions of Watts Branch were developed with no stormwater treatment practices or facilities that only provide peak discharge controls for larger storm events (e.g., the 2 or 10 year storms) that have little capability to control channel erosion or provide water quality controls. As presented in Section 1, stormwater retrofits are being pursued as one of the tools of the Watts Branch Watershed Management Plan. The primary purpose of the retrofits is to provide channel protection storage to reduce the amount of channel erosion occurring and water quality treatment to reduce the pollutant loading to the stream during stormwater runoff events.

In August 1999, the Center for Watershed Protection, with help from the City of Rockville staff, conducted a retrofit inventory for Watts Branch within the City of Rockville. This section describes the process of locating and identifying potential stormwater retrofits for Watts Branch. Figure 3.1 illustrates the location of the candidate retrofit sites. Appendix E contains the full retrofit inventory sheets where each site is described in detail and a conceptual sketch of the most likely retrofit option is presented.

3.1 The Watershed Retrofitting Process

Watershed retrofitting should be viewed as a long term process involving a myriad of disciplines from natural resources management, to engineering design, to public policy and education. Since every watershed is different, it is challenging to break such a complicated process into a step-wise, "cookbook" approach. However, there are eight basic elements that are key to a successful retrofitting effort. Table 3.1 presents this step-by-step approach to stormwater retrofitting developed by the Center for Watershed Protection staff over the past several years. The table also indicates the status of each step at this point in the development of the watershed management plan for Watts Branch.

Phase I of the study investigated all possible stormwater opportunities and prioritized them. The results of the ranking are presented in Section 3.4. Under Phase II of the project, the highest ranking retrofits were carried forward to the conceptual design stage (see step 5, in Table 3.1).

Retrofits come in many shapes and sizes, from large regional retention ponds that provide a variety of controls, to small on-site facilities providing only water quality treatment for smaller storms. Usually at least some kind of practice can be installed in almost any situation. But fiscal constraints, pollutant removal capability, practical physical limitation and watershed capture area must all be carefully weighed in any retrofit selection criteria. For Watts Branch we placed an emphasis on identifying locations and practices that have the capability to manage and treat larger drainage areas, have a lower maintenance burden, and have a proven track record for effective pollutant removal capability.

Figure 3.1 Candidate Retrofit Sites

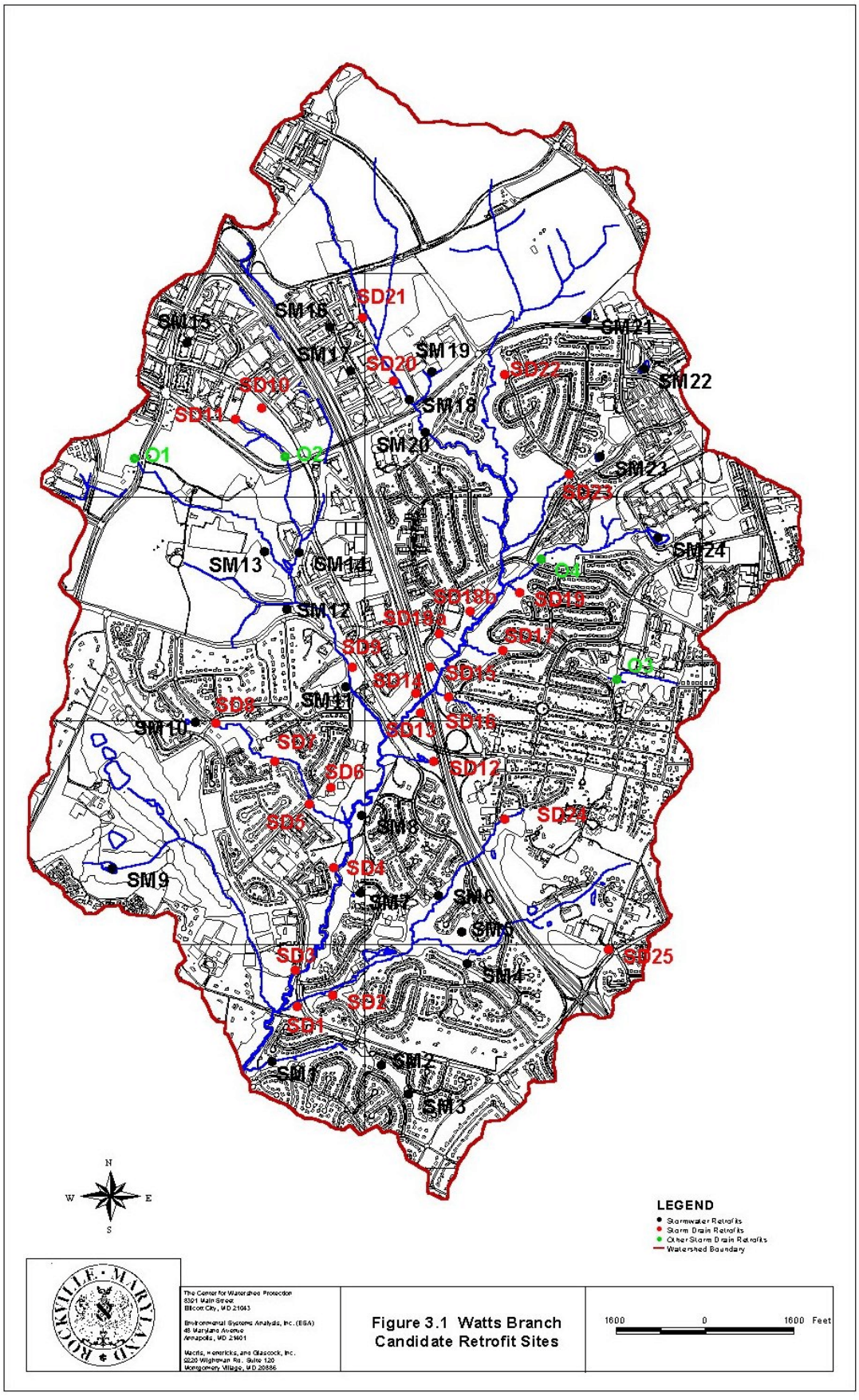

Table 3.1 Basic Elements of a Stormwater Retrofitting Implementation Strategy

Step	Element	Purpose	Status
1.	Preliminary Watershed Retrofit Inventory	Identify potential retrofit sites	✔
2.	Field Assessment of Potential Retrofit Sites	Verify that sites are feasible and appropriate, produce concept designs.	✔
3.	Prioritize Sites for Implementation	Set up a priority for implementing future sites	✔
4.	Public Involvement Process	Solicit comments and input from the public and adjacent residents on potential sites	✔
5.	Retrofit Design	Prepare construction drawings for specific facilities	✓
6.	Permitting	Obtain the necessary approvals and permits for specific facilities	✓
7.	Construction Inspections	Ensure that facilities are constructed properly in accordance with the design plans	-
8.	Maintenance Plan	Ensure that facilities are adequately maintained	-

✔: Step is complete

✓: Step has been initiated but is not yet complete

- : Step has not been started

The first step in retrofit implementation is the process of identifying feasible and appropriate sites. This involves a process of identifying as many potential sites as rapidly as possible. The best retrofit sites fit easily into the existing landscape, are located at or near major drainage outlets or existing stormwater control facilities, and are easily accessible. For example, the watershed area southwest of I-270 contains several existing dry stormwater detention facilities that were constructed in the past for flood control. In the older neighborhoods northeast of I-270, there are several stormwater outfalls and other water features where suitable opportunities exist for retrofits. Table 3.2 lists some of the most likely spots for locating facilities and some common applications.

Table 3.2 Some of the Best locations for Stormwater Retrofits

Location	Type of Retrofit
Existing stormwater detention facilities.	Usually retrofitted as a wet pond or stormwater wetland capable of multiple storm frequency management
Immediately upstream of existing road culverts	Often a wet pond, wetland, or extended detention facility capable of multiple storm frequency management
Immediately below or adjacent to existing storm drain outfalls	Usually water quality only practices, such as sand filters, vegetative filters or other small storm treatment facilities
Directly within urban drainage and flood control channels	Usually small scale weirs or other flow attenuation devices to facilitate settling of solids within open channels
Highway rights-of-way and cloverleaves	Can be a variety of practices, but usually ponds or wetlands
Within large open spaces, such as golf courses and parks.	Can be a variety of practices, but usually ponds or wetlands capable of multiple storm frequency management
Within or adjacent to large parking lots	Usually water quality only facilities such as sand filters or other organic media filters (e.g., bioretention)

The first step is completed in the office using topographic mapping (the City's 5' contour interval GIS mapping is quite satisfactory), low altitude aerial photographs, the storm drain master plan, and land use maps. Scouting for potential candidate sites follows the guidance discussed above in Table 3.2. Two important tasks need to be undertaken before venturing into the field. First, the drainage area to each retrofit is delineated and second, the potential surface area of the facility is measured. The drainage area is used to estimate a potential capture ratio. This is the percentage of the overall watershed that is being managed by all retrofit projects. The potential surface area is used to compute a preliminary storage volume of the facility. A short cut storage volume can be computed by multiplying two-thirds of the facility surface area times an estimated depth ($\frac{2}{3} \cdot SA \cdot d$). These two pieces of information are used as a quick screening tool. In general, an effective retrofitting strategy attempts to capture at least 50% of the watershed area. A minimum water quality target storage volume for each retrofit is equal to approximately ½ inch per impervious acre[1]. For channel protection purposes, a target storage volume is to provide 24-hour extended detention for the 1-year return frequency storm (the 1-year storm for the Watts Branch vicinity is approximately 2½ inches).

[1] Although the recently adopted Maryland Department of Environment water quality regulations require treatment of approximately 1" of runoff per impervious acre, the Center and the City agreed that this is unmanageable in retrofit situations within the City. Available space, tree preservation concerns, and resident support made the ½ inch target a better fit for the community and more realistic to achieve.

The candidate retrofit sites are then investigated in the field to verify that they are feasible. This field investigation involves a careful assessment of site specific information such as identifying the presence of sensitive environmental features, the location of existing utilities, the type of adjacent land uses, the condition of receiving waters, construction and maintenance access opportunities, and most importantly, whether or not the contemplated retrofit will actually work in the specified location. A conceptual sketch is prepared, photographs are take, and the retrofit inventory form is completed for each site (see Appendix E).

3.2 Watts Branch Retrofit Inventory and Assumptions

The Watts Branch retrofit inventory was conducted during the summer of 1999. The preliminary office investigation (using aerial photography, planimetric base mapping, and storm drain mapping) identified 54 candidate stormwater retrofit sites (see Figure 3.1 for locations). Screening criteria were employed to target larger outfalls and existing ponds so that the number of candidate sites to investigate would be reasonable and the total watershed area potentially addressed was maximized (as stated previously, a goal of the retrofitting process is to capture at least 50% of the watershed area). The screening criteria generally meant that existing underground storage practices or smaller parking lots would not be evaluated, since the typical contributing drainage area is less than 5 acres. The ideal target for each site was to provide 100% of both the water quality and channel protection storage. However, based on the observations and analysis associated with the channel geomorphic assessment (i.e., that most of the channel was experiencing significant and active erosion), a slight bias towards providing channel protection storage volume was instituted. Water quality only facilities were not generally considered due to high cost-benefit ratio to the overall watershed.

Twenty-six of these sites are at, or immediately adjacent to, a storm drainage outfall of at least 30" diameter (designated as "SD" sites). The 30" pipe size limit was selected as the screening level to obtain a reasonable minimum drainage area for candidate sites. Another 24 candidate sites are at existing pond sites, generally stormwater detention or retention facilities (designated as "SM" sites). In general, candidate stormwater sites have a drainage area of at least seven to ten acres (again to obtain a reasonable minimum area for candidate sites) and were constructed prior to 1993. For example, existing stormwater facilities associated with the King Farm and Rose Hill developments were not investigated, as these facilities were designed and constructed based on more advanced water quality criteria. It was assumed that these facilities were generally providing their intended water quality control. The remaining four sites (designated as "other" or "O") are at locations with a significant drainage area upstream from an existing road culvert or at the intake of a major drainage system.

Of the 54 original candidate sites, 17 were deemed infeasible or impractical based on the field reconnaissance (ten "SD" sites, four "SM" sites, and three "O" sites). The reasons for dropping a site from further consideration generally were because of too little available area, poor or impractical construction and/or maintenance access, or the presence of existing natural features such as non-tidal wetlands. Appendix E describes in detail the reasons why particular sites were dropped from further consideration.

3.3 Ranking System

A retrofit ranking system was developed to provide a quantitative evaluation to prioritize candidate stormwater retrofit sites. The criteria and the assigned weighting were developed based on best professional judgement, input from the Watts Branch Partnership, City staff and experience. The following discussion provides the rationale for selecting the factors and assigning the weights.

The retrofit ranking system evaluates sites based on criteria in two major categories – a "technical features" category and an "environmental and community goals" category. The two categories help determine how well a project meets the water resources objectives at a location as well as how it satisfies community concerns. The technical features category contains eight ranking criteria:

- Impervious area treated
- Percent of channel protection target volume treated
- Percent of water quality target volume treated and pollutant load reduction
- Project cost
- Land ownership and availability
- Ease of access
- Future maintenance burden
- Impact on utilities

The environmental and community goals category contains four ranking criteria:

- Forest and tree preservation
- Recreation preservation
- Wetlands preservation
- Community acceptance

The specific groupings of each criteria are presented below in Table 3.3

Table 3.3 Retrofit Ranking Criteria

Stormwater Management and Site Technical Features Criteria

1. Impervious Area Treated – How many acres of paving or rooftops drain to this facility?

0 < drainage area ≤ 30 acres

30 < drainage area ≤ 50 acres

50 < drainage area ≤ 70 acres

70 < drainage area ≤ 90 acres

Drainage area > 90 acres

2. % of Channel Protection Target Volume (2.5"/impervious acre) Treated -
Based on the volume of runoff which needs to be controlled to reduce downstream erosion, how much of this runoff will fit into the facility?

0%< capture ≤ 20%

20%< capture ≤ 40%

40%< capture ≤ 60%

60%< capture ≤ 80%

80%< capture ≤ 100%

3. Water Quality Target (consists of two parts)

3a. % of Water Quality Target Volume Treated - Based on the volume of runoff which needs to be controlled to treat 90% of the average annual stormwater runoff. How much of this runoff will fit into the facility?

0%< capture ≤ 20%

20%< capture ≤ 40%

40%< capture ≤ 60%

60%< capture ≤ 80%

80%< capture ≤ 100%

3b. Pollutant Load Reduction: TSS & TP – How effective is the proposed SWM method at removing suspended solids and phosphorus, two indicators of urban pollution?

Open channel/plunge pool/outfall treatment

Dry ED pond with micropool

Wet ED pond or wetland marsh

Bioretention or other filtration practice

4. Project Cost ($/acre tributary to facility) - Costs include consideration of design, permitting and construction. How much will the facility cost, taking into account the size of the drainage area?

> $5,000/acre of drainage area

$4,000 ≤ project cost < $5,000

$3,000 ≤ project cost < $4,000

$2,000 ≤ project cost < $3,000

$1,000 ≤ project cost < $2,000

< $1,000/acre of drainage area

5. Ownership and Availability – How difficult is it to secure use of the site for a modified or new SWM facility?

Private site, no easement

Private site with existing SWM facility OR public site with no current SWM facility

Public site with current SWM facility

6. Access – How disruptive or difficult will it be to move construction or maintenance vehicles to and from the site?

Poor – examples: requires easements through private lots, removes many trees, grade problems.

Good

Excellent – examples: easily constructed or good existing access path across common open space or public land.

7. Maintenance Burden – Based on SWM method – assumes proper pre-treatment and includes long term maintenance needed to keep/restore function)

High maintenance (e.g., open channels, plunge pools, outfall treatments, dry ED ponds, bioretention, filtration) – needs debris/sediment removal more frequently than once/year; will fail to function if not maintained and/or must be rebuilt to restore function once it fails (e.g., filtration).

Medium maintenance (e.g., dry ED ponds with micropools) – needs debris/sediment removal more than once a year.

Low maintenance (e.g., wet ponds, wetland marshes) – infrequent maintenance; will not fail for long period of time even without regular maintenance

8. Utilities Impact – How difficult will existing utilities such as sewer or gas lines make proposed SWM construction?

Major impacts – underground line must be relocated (> $20,000 cost) or site layout is significantly constrained by utilities

Minor impacts – site layout is slightly constrained by utilities or project requires minor relocation (< $20,000 cost)

No impacts

Environmental and Community Goals Criteria

1. Forest and Tree Preservation – How does this project affect trees within the overall site? (Note: significant trees are defined in the City's Forest Conservation Manual as 24" diameter within forests or 12" diameter outside of forests.)

Loss of > 2.0 acres of forest or 80%-100% of existing significant trees from site

Loss of 1.5 to 2.0 acres of forest or 60%-80% of existing significant trees from site

Loss of 1.00 to 1.5 acres of forest or 40%-60% of existing significant trees from site

Loss of 0.5 to 1.00 acres of forest or 20%-40% of existing significant trees from site

Loss of up to 0.5 acres of forest or up to 20% of existing significant trees from site

No loss of forest or existing trees

2. Recreation Preservation – How does this project affect formal or informal recreational opportunities (both existing and planned future recreational features) at the site?

Total loss of currently programmed major athletic field or major recreational facility (e.g., Rec. Center) without possibility to mitigate the loss at any time

Total loss of currently programmed major athletic field or major recreational facility (e.g., Rec. Center) with the possibility to mitigate the loss within the normal 5-year projection of the Capital Improvement Program

Total loss of currently programmed minor athletic field or minor recreational facility (e.g., shelter, play equipment over $100k, etc.) without possibility to mitigate the loss at any time

Total loss of recreational amenities or open space (that is not programmed) without possibility to mitigate the loss within the normal 5-year projection of the Capital Improvement Program

No loss of existing athletic fields, recreational facilities, or programs

3. Wetlands Preservation – How does this project affect known or apparent wetlands at the site?

Net loss of > 0.50 acres of wetland

Net loss of 0.25 to 0.50 acres of wetlands

Net loss of 0.12 to 0.25 acres of wetland

Net loss of up to 0.12 acres of wetland

Either net gain or no loss of wetlands

4. Community Acceptance (<u>pick all that apply</u>)

Facility fits into scale of overall location and character of site

Not visible from nearby houses

Not visible from nearby play areas (tot lots, recreation centers, pools, etc.) – only applies to wet ponds or other deep water practices for safety concerns

Site already has a stormwater practice located on it

The Center adopted a ranking approach based on a benefit/cost concept, whereby criteria were defined based on whether they generate benefits or costs. For example, impervious area treated and pollutant load reduction were considered "benefits" of a retrofit, while the project cost, access, and maintenance burden were considered "costs" associated with the retrofit. A "net benefit" was generated by summing the positive points awarded to benefits and negative points awarded to costs criteria. In addition, a benefit/cost ratio was calculated which provided a relative index for each retrofit site (i.e., identifies sites with the most "bang for the buck"). An iterative process was used to arrive at the final ranking that involved input from and participation with the Watts Branch Partnership.

A series of five scenarios were evaluated with different point weighting to determine the sensitivity of the ranking scheme. The five scenarios included:

Scenario 1. Original City ranking, which placed equal weight on the technical and community based criteria.

Scenario 2. Reweighted scores that gave greater weight to treated area, channel protection, water quality, and forest preservation and less weight to all other criteria.

Scenario 3. Reweighted scores that gave greater weight to treated area, channel protection, water quality, and forest and wetland preservation and less weight to all other criteria.

Scenario 4. Reweighted scores that gave greater weight to treated area, channel protection, water quality, recreation, and community acceptance and less weight to all other criteria.

Scenario 5. Reweighted scores that gave greater weight to the water quality and channel protection criteria as a function of total impervious area treated (i.e., those sites that treat more impervious area was weighted more heavily). In addition, greater weight was given to forest preservation.

Scenario 5 was the Center's recommended scenario (and ultimately the agreed approach by the City and Partnership), as it reflected a weighting that places more emphasis on a site's ability to provide water quality and channel protection benefits. Based on the Center's past experience and best professional judgement, we feel that these criteria merit a greater emphasis and are key to meeting the overall goals of the Watts Branch Watershed Plan.

3.4 Priority of Sites Based on Ranking System

To simplify the presentation of the sensitivity analysis, the Center focused on the relative ranking of the benefit/cost ratio of each site for the five scenarios described above. Table 3.4 presents the results of the analysis. The table has been sorted based on the ranking of Scenario 5, where sites are listed from highest to lowest (i.e., best to worst) benefit/cost ratio rank.

As can be seen in Table 3.4, the top 15 ranked sites are shared in most scenarios but their rank order often differed. In a few cases there are large variations between one or more of the scenario ranks for a given site. For example, site SM-16 is ranked 15 under the City's scenario (Scenario 1), but is ranked between 24 and 30 in the other four scenarios. This is due to the fact that this site received favorable scores for the four community-based criteria (i.e., low "costs") under the City's point system. These four criteria make up over 60% of the "costs" associated with the project. Under the other four scenarios, where water quality related criteria are given more weight, and some of the community-based criteria are reduced in weight, the rank of site SM-16 drops. Similar explanations apply to the other sites where large variations in rank exist.

Table 3.4 Retrofit Ranking Results

Cost/Benefit Ranks

Site ID	City Scores Scenario 1	Reweighted Scenario 2	Reweighted Scenario 3	Reweighted Scenario 4	Reweighted Scenario 5	Special Notes
SM-8	2	1	1	9	1	*
SM-24	1	3	3	2	2	*
SM-1	6	4	4	3	3	
SM-3	4	5	5	7	4	
SM-22	2	2	2	1	5	*
SD-12	5	9	8	12	6	
O-3	13	14	12	18	7	
SM-23	9	6	7	8	8	
SD-8	24	16	17	23	9	
SM-9	7	7	6	6	10	*
SM-20	14	8	10	4	11	
SM-18	22	10	11	5	12	
SD-24	28	13	14	13	13	
SM-14	16	15	15	11	14	
SM-19	23	25	33	16	15	*
SD-22	20	23	25	20	16	**
SD-6	19	19	20	26	17	**
SD-16	26	24	26	24	18	**
SM-21	11	20	16	15	19	**
SM-2	8	12	9	14	20	**
SM-10	17	22	22	22	21	
SM-4	18	17	18	17	22	
SD-15	29	28	31	27	23	
SD-9	26	27	29	28	24	
SD-18b	32	21	21	21	25	
SM-7	12	18	19	19	26	
SM-6	10	11	13	10	27	
SD-7	31	26	28	29	28	
SD-19	35	32	35	34	29	
SM-16	15	29	24	25	30	
SD-2	36	31	27	36	31	
SD-4	34	32	34	32	32	
SM-15	25	35	32	31	33	
SD-13	33	36	36	33	34	
SM-17	21	34	30	30	35	
SD-18a	30	30	23	35	36	
SD-1	37	37	37	37	37	

Notes:
Scenario 1 = Original City ranking, adjusted to a one-dimensional score using the benefit/cost approach.
Scenario 2 = Greater weight to treated area, Cpv, water quality, and forest preservation and de-emphasis of all other criteria.
Scenario 3 = Greater weight to treated area, Cpv, water quality, and forest and wetland preservation and de-emphasis of all other criteria.
Scenario 4 = Greater weight to treated area, Cpv, water quality, recreation, and community acceptance and de-emphasis of all other criteria.
Scenario 5 = Greater weight to the water quality and Cpv criteria as a function of total impervious area treated (i.e., those sites that treat more impervious area will be weighted more heavily). The remaining criteria under this scenario are the same as Scenario 2.

Special Notes:
Cpv = channel protection storage
* = Site already provides some level of water quality and channel protection volume.
** = Site merits consideration if "*" sites are deemed lower priority due to already good water quality and/or channel protection benefits (i.e., at City's discretion).

It is of note that five of the top 15 sites (all existing stormwater management facilities) already provide some level of water quality and/or channel protection benefits; therefore, they tend to receive higher "benefit" points than the other sites. These sites are identified by an asterisk in the last column of Table 3.4. Since these sites are already providing a certain level of treatment, the City may deem them to be lower in priority than some of the other sites. To account for this, five additional sites (rank 16-20) have been identified as candidates to replace the asterisk sites. These alternative sites are identified by a double asterisk in the last column of Table 3.4.

Eighteen of the top 20 stormwater retrofit sites were ultimately selected to proceed to the conceptual design level, after review and discussion between City staff, the Partnership and the Center. Table 3.5 presents the sites along with their rank, proposed stormwater treatment practice, tributary drainage area, and impervious area treated.

Table 3.5 Stormwater Retrofit Sites Identified for Concept Design

Site ID	Rank	Stormwater Treatment Practice	Tributary Drainage Area (Acres)	Impervious Area Treated (Acres)
SM-8	1	modify pond bottom and add forebays	49	13
SM-24	2	modify existing wet ED pond	123	68
SM-1	3	ED with micropool	80	18
SM-3	4	ED with micropool	88	19
SM-22	5	modify outlet to provide channel protection storage	15	12
SD-12	6	ED with micropool	27	9
O-3	7	shallow marsh wetland	53	16
SM-23	8	wet pond	84	44
SD-8	9	wet pond	181	45
SM-9	10	modify existing storage and provide wet swale	46	9
SM-20	11	ED with micropool	349	54*
SM-18	12	ED with micropool	332	48*
SD-24	13	ED with micropool	68	20
SM-19	15	ED with micropool	18	10
SD-22	16	shallow marsh wetland	31	8
SD-6	17	ED with micropool	39	10
SD-16	18	ED with micropool	37	9
SM-2	20	ED with micropool	17	4

Notes: ED = extended detention

* = Area treated does not include upstream King Farm drainage.

3.5 Recommended Stormwater Management Projects

The following summaries describe the SWM projects approved in the 2001 Watts Branch Watershed Study. Together, they will provide full or partial treatment of 1,087 acres of drainage area, equivalent to about 26% of the City's portion of the Watts Branch watershed. State-of-the-art SWM at the King Farm and Fallsgrove developments will provide treatment for an additional 800 acres. Together, this will offer modern SWM treatment to approximately 45% of the City's Watts Branch watershed. A condensed tabular summary of the projects is provided in Table 3.6 at the end of the short descriptions.

ID: SM1
Name: Horizon Hill #3
Type: Dry Pond with Micropool
Drainage Area = 185 acres

Concept: This existing dry pond is located in Horizon Hill Park between Starlight Court and Sunrise Drive. It would receive a forebay east of the playground and a micropool next to the dam, ranging in depth from a few inches at the edges to 4 feet deep at the center. These pools would help settle out sediment and prevent clogging of the pond's control structures. Grading would be limited to the pool areas; the stream valley between the pools would temporarily pond water for up to 24 hours after storms, but would remain as undisturbed shrub or wooded wetlands. The existing corrugated metal risers would be replaced with concrete control structures to provide the appropriate release rates. This pond will be designed in conjunction with Horizon Hill # 1 and #2 (SM3 and SM2) to work in series.

Advantages: Preserves natural stream valley setting and enhances wetlands; improves appearance of control structures; achieves full SWM control

Disadvantages: Grassed areas of park converted to shrubs/woods; clears about 9 trees bigger than 8" diameter; clearing may be visible from 13 houses

ID: SM2
Name: Horizon Hill #2
Type: Dry Pond with Micropool
Drainage Area = 105 acres

Concept: This existing dry pond, located in Horizon Hill Park between Pebble Ridge Court and Glastonberry Road, would receive a single micropool upstream of the dam ranging in depth from a few inches at the edges to 4 feet deep at the center. Grading would be limited to the pool area; the stream valley upstream of the pool would temporarily pond water for up to 24 hours after storms, but would remain as undisturbed shrub or wooded wetlands. The existing corrugated metal risers would be replaced with concrete control structures to provide the appropriate release rates. This pond will be designed in conjunction with Horizon Hill # 1 and #3 (SM3 and SM1) to work in series.

Advantages: Preserves natural stream valley setting and enhances wetlands; improves appearance of control structures; achieves full SWM control

Disadvantages: Grassed areas of park converted to shrubs/woods; clears about 6 trees bigger than 8" diameter; clearing may be visible from 9 houses

ID: SM3
Name: Horizon Hill #1
Type: Dry Pond with Micropool
Drainage Area = 88 acres

Concept: This existing dry pond, located in Horizon Hill Park between Longhill Drive, Richview Court and Glastonberry Road, would receive three permanent pools (two forebays and a micropool) ranging in depth from a few inches at the edges to 3-4.5 feet deep at the center, depending on the pool. The pools would be located at the end of storm drain pipes flowing into the pond as well as upstream of the dam. Most of the area would be graded, then restored as shrub or wooded wetlands except for the permanent pools and the central stream channel. The existing corrugated metal risers would be replaced with concrete control structures to provide the appropriate release rates. This pond will be designed in conjunction with Horizon Hill # 2 and #3 (SM2 and SM1) to work in series.

Advantages: Preserves natural stream valley setting and enhances wetlands; improves appearance of control structures; achieves full SWM control

Disadvantages: Grassed areas of park converted to shrubs/woods; clears about 15 trees bigger than 8" diameter; clearing may be visible from 9 houses

Horizon Hill #1,2 & 3 Recommendation: The Horizon Hill ponds were built in 1977. The majority of residents who commented on the Horizon Hill ponds requested that the existing corrugated metal pipe (CMP) risers be replaced to improve the appearance. Since these risers are about 25 years old, they will be nearing the end of their life expectancy over the next ten years. Staff therefore recommends replacing the risers with concrete structures. The concrete may be tinted to help the structures blend into the surroundings. The CMP barrels through the dams should also be inspected during final design, and rehabilitated or replaced, if needed, to extend their life. The existing dams should also be inspected and trees removed if required by dam safety regulators.

All of the Horizon Hill retrofits will require state/federal permits. The wetland/waterway regulatory agencies visited the SM1 site in November, 2000, as representative of these projects. Their recommendations included investigating a riser design that would maintain fish passage through the pond's barrel, if at all possible. They also suggested that the City consider wider shallow marsh areas in the permanent pools for enhanced habitat value. The City will need to justify the on-line concepts at the permitting stage by demonstrating the lack of off-line alternatives for the forebay cells and for the ponds themselves. However, this must be weighed against the greater disturbance to the park by placing a plunge pool at each storm drain outfall.

In the early 1980s, a paved pedestrian path was added along the southern boundary of Horizon Hill Park. Much of it is within the existing 2-year flooding areas from each of the SWM ponds. It is chronically damp or has puddles at certain points from a combination of low spots on the path, backwater from ponding in the SWM facilities and drainage from adjacent lots. The Department of Recreation and Parks (R&P), as well as several residents, have requested that drainage along this

path be improved when the ponds are retrofitted. Given the narrowness and relatively gentle slopes of the stream valley, the path's current location will always be prone to frequent flooding. Although elevating the path above the 10-year water surface elevation will not be possible as requested, DPW will work with R&P to make the path more usable by improving drainage and regrading as much as possible without disturbing nearby trees.

The SWM concept also suggested converting the SWM basin areas from mowed grass to a shrub/forested wetland, both for better filtration of overflow storms and for habitat improvement. These areas already exhibit wetland characteristics and a 1992 drainage project was built in Horizon Hill #1 to dry out the bottom of the pond. Reclaiming the stream valley as a natural ecosystem would be an environmental benefit to the Watts Branch watershed and would create a more wooded backdrop for the residents along Horizon Hill Park. The City Forester also recommended using the Horizon Hill Park as a reforestation area. A 10-20 foot area near the pedestrian path should be maintained in grass for dogwalkers and other residents who wish to enjoy the park. The renaturalization may also reduce the amount of trash and yard trim dumping cited by several residents as a chronic problem in the park. This issue should be discussed further with local residents at the final design stage to determine the level of passive recreation in the park. The SWM projects are workable independant of the conversion from grass to shrub/forest.

ID: SM-8
Name: Aintree Pond
Type: Shallow Marsh
Drainage Area = 53 acres

Concept: This existing wetland marsh SWM pond would have minor modifications to the concrete control structure which drains the pond to adjust the 1-year, 24-hour extended detention release rate for better erosion control. Some minor regrading is recommended at the storm drain inflows to the pond to create sediment forebays which will prevent sediment from spreading evenly throughout the pond. This would result in a planted peninsula between each inflow point and the control structure, thus adding to the vegetated appearance of the marsh.

Advantages: Accelerates transition to final marsh appearance; reduces future maintenance problems and avoids future mass disturbance of wetland plants for cleanout of pond

Disadvantages: requires additional construction activity in neighborhood; some existing wetland plants will be disturbed and will require several growing seasons to re-establish on the peninsulaes

Recommendation: Staff continues to work with local residents on the existing pond's appearance and wetland marsh design. Concerns focus primarily on plant placement and selection, whether the pond is supporting a large mosquito population, and the presence at times of trash, algae and duckweed. In 2001, staff met with the community to review several alternatives to enhance the pond's appearance. Most of the residents were satisfied with the pond's appearance and asked that it not be changed further at this time. The community decided to evaluate the pond's appearance in 2003 so that the landscaping can mature and fill in naturally. If the appearance does not meet the community's expectations at that time, staff will consider modifications to the pond, including additional landscaping, regrading the pond bottom, adding boulders along the pond's edge and riser

modifications. DPW successfully tried an algae suppression program in the summer of 200, using barley bales staked into this pond to reduce an algal bloom. The City will also need to continue educating residents to the benefits of wetland ecosystems.

ID: SM-9
Name: Lakewood Country Club
Type: Wet Pond
Drainage Area = 46 acres

Concept: This existing wet pond on the south side of the golf course already functions as a SWM pond. It is maintained by the City and is within a public SWM easement since it receives offsite drainage from the National Lutheran Home. Minor modifications are proposed, including a storm drain outfall relocation, addition of a forebay, and changes to the control structure to provide the appropriate release rates.

Advantages: simple, low-cost retrofit; no change in appearance, achieves full SWM control

Disadvantages: construction will disrupt golf course

Recommendation: This project will require coordination with the Country Club Groundskeeper to minimize turf damage and disruption to golf course usage during construction.

ID: SM-18
Name: 270 Industrial Park Pond
Type: Dry Pond with Micropool
Drainage Area = 322 acres

Concept: This existing dry pond would be modified to add two small permanent pool forebays and a permanent micropool upstream of the gabion weir control structure, and to modify the outflow system by adding a metal or concrete riser to prevent clogging and provide the appropriate release rates. This pond will be designed in conjunction with SM-20 (Carnation Drive) and SM-19 (PEPCO) to work in series.

Advantages: partial improvement of SWM control

Disadvantages: space constraints and nearby office building elevation limit expansion due to potential flooding; micropool design must avoid existing sanitary sewer through center of pond.

Recommendation: This retrofit will require state/federal permits. The wetland/waterway regulatory agencies viewed this site in November, 2000. The floodplain upstream of the gabion wall appears to be palustrine forested wetlands, but not of high quality (no apparent springs or seeps, no unusual habitat). Since the existing stream channel is fairly shallow now, the agencies recommended that the west side of the overbank area be excavated to form a shallow marsh offline, but parallel to, the stream channel. A diversion weir at the upstream pond limit would divert stormflows into the offline depression, which would tie back into a micropool at the new low-flow pipe in the gabion

wall. This would replace the online forebays, thus maintaining more open stream channel for fish passage and creating more diverse wetland habitat.

The City Forester recommends that the more open area upstream be investigated at final design. Achieving water quality/forebay storage in this area would lessen the forest clearing needed closer to the control structure. This will be assessed after a complete Natural Resources Inventory, including trees and wetlands, is done.

ID: SM-19
Name: PEPCO Pond
Type: Dry Pond with Micropool
Drainage Area = 19 acres

Concept: This existing dry pond would be modified to add two small permanent pool forebays and a permanent micropool upstream of the control structure, and to modify the control structure to provide the appropriate release rates. This pond will be designed in conjunction with SM-20 (Carnation Drive) and SM-18 (270 Industrial Park) to work in series.

Advantages: partial improvement of SWM control

Disadvantages: space constraints limit expansion

Recommendation: At this time, the City does not anticipate funding this private retrofit. In the event of redevelopment, the City will work with PEPCO to facilitate this project, perhaps through PEPCO's environmental improvements program.

ID: SM-20
Name: Carnation Drive
Type: Dry Pond with Micropool
Drainage Area = 358 acres

Concept: This existing dry pond between Aster Boulevard and Larkspur Terrace would be modified to add two permanent pool forebays and a micropool upstream of the existing gabion wall, and to modify the outflow system by adding a concrete control structure to prevent clogging and provide the appropriate release rates. The stream channel would be diverted towards the east side of the existing pond into the micropool area. Undisturbed woods would remain in the west side of the pond, although they would experience temporary ponding for up to 24 hours after storms. This pond will be designed in conjunction with SM-18 (270 Industrial Park) and SM-19 (PEPCO) to work in series.

.

Advantages: partial improvement of SWM control; will help reduce erosion problems immediately downstream

Disadvantages: Approximately 1 acre of forest clearing required; clearing will be visible from 9 houses; micropool design must avoid existing sanitary sewer through center of pond.

Recommendations:

The Partnership recommended that the upstream forebay (closest to Gude Drive) be omitted, if possible, at final design to reduce necessary clearing. This forebay may be unnecessary given the sediment/trash removal in the I-270 Industrial Park pond immediately upstream of Gude Drive on this tributary. At final design, the consultant should investigate this and determine whether this will result in a significantly smaller limit of disturbance. The combining of the western forebay and the micropool should also be investigated at final design in an effort to reduce clearing. Final grading needs to provide positive drainage to the existing stream channel that remains within the pond basin; it is expected that this will revert to a wetland condition. A wooded buffer should also be maintained between the pond and the adjacent house to the north on Carnation Drive.

This retrofit will require state/federal permits. The wetland/waterway regulatory agencies will probably have similar comments regarding offline permanent pools offline as for 270 Industrial Park. However, Carnation Drive has existing fish passage barriers both at Gude Drive and Carnation Drive. The existing sewer line placement also constrains alternate flowpaths. Offline water quality pools may not be as feasible or necessary in this pond as in the 270 Industrial Park site. The City will work with the regulatory agencies at final design to resolve these issues.

ID: SM-22
Name: College Gardens Office Park
Type: Wet Pond
Drainage Area = 15 acres

Concept: This existing SWM wet pond, located within a private office complex would be modified to add a forebay and change the control structure to provide the appropriate release rates. A baffle would also lengthen the flow path within the pond.

Advantages: simple, low-cost retrofit

Disadvantages: private pond; small drainage area makes this minimally effective for overall watershed improvements unless combined with College Gardens Park project.

Recommendation: At this time, the City does not anticipate funding this private retrofit, but will work with the owner to facilitate this project. The owner's management company has discussed the possible retrofit with the City.

ID: SM-23
Name: College Gardens Park Pond
Type: Wet Pond
Drainage Area = 84 acres (15 acres in this sub-watershed may be treated by SM-22)

Concept: This existing wet pond in College Gardens Park would be expanded to treat runoff diverted from a large storm drain pipe in the park. A wetland marsh fringe (2-12" deep) would be planted around the edges, and would have deeper water of 4 feet deep at the upper end near the ball field and 6.5 feet in the center of the main pool. A peninsula separating the forebay and the main

pool would add visual interest. The expanded pond would encompass the sand volleyball court and pavilion; both of these could be relocated to another location in this park. The concept calls for saving most of the trees on the existing dam and many large trees near College Parkway. A concrete control structure and outfall pipe would be added to replace the deteriorating riser that returns drainage to the storm drain system. This project is the only one in the watershed study which is an existing pond, but is not currently a SWM pond; the consultants therefore classified it with an 'SM-' designation to reflect that it would be a modification of an existing pond site. The 'SM-' designation does not imply that a site is necessarily serving as a current SWM facility.

Advantages: achieves substantial SWM control for subwatershed; can add ornamental features to design and setting; maintains similar depth and permanent water surface area of existing pond; educational opportunity for adjacent College Gardens E.S. schoolchildren and summer Recreation Dept. programs

Disadvantages: disturbs heavily used park; requires relocation of pavilion and volleyball court; reduces grassed area for active and passive recreation; clears about 30 trees bigger than 8" diameter; clearing may be visible from 15 houses

Alternatives Considered In Study:

Staff met numerous times with the College Gardens Civic Association to discuss alternatives to this proposal. The civic association formed a subcommittee to comment separately from the Watts Branch Partnership on the two SWM alternatives proposed for this neighborhood. The initial comments received from the civic association are included in the appendices. To preserve the park's open space, the civic association asked the City to consider several alternatives, which were investigated by DPW staff and the Center.

Staff assessed burial of the proposed pond forebay in an underground concrete vault to keep the upper area of the pond in grass instead of a wet pool. Based on the forebay's projected volume, this vault would cost roughly $224,000 for concrete alone, compared to about $3,000 in excavation costs for a surface forebay. The vault would also need manholes or access doors for cleanouts and inspections. If this vault was placed within either the park or the adjacent ballfield, the access structures would make the grassed area unsafe for active recreation. Additionally, multiple underground water quality structures throughout the storm drain network were considered and cost estimates developed. This would be extremely expensive, much more of a maintenance burden and less effective in pollutant removal than wet pond treatment. Staff therefore recommends against these alternatives.

Staff also explored using the stream valley downstream of Princeton Place for SWM in lieu of College Gardens Park. The storm drain through College Gardens Park empties into a wooded stream channel behind houses on the north side of College Parkway. Early in the SWM Inventory, this alternate site (SD23) was investigated by the Center and rejected because of the increased drainage area, the need for an in-stream dam, steep wooded slopes on one side, and nearby houses along College Parkway. The drainage area increases from 84 acres in College Gardens Park pond to roughly 120 acres at the storm drain outfall.

After revisiting the site during the Open House period, staff and the Center still found this site problematic, even for a pond to control only part of the drainage area. Because of the houses' flat backyards, the dam would not only block the stream but wrap around the side to form a levee between the pond and the houses, which would increase dam safety hazards. The City Forester also recommended against this alternative because of the significant forest clearing needed to excavate the storage basin below the inflow culvert's invert. Finally, federal and state wetland regulators informed staff that this location would not be permittable if an alternative exists which has no wetland impacts. As a result, this location was rejected by City staff as impractical.

Another suggestion was to build a single large dry pond on this tributary closer to the mainstem. This would avoid the dam safety issues for the houses along College Parkway, but would increase the drainage area even more, resulting in a much larger pond, and move the disturbance deeper into the woods and further down the stream channel

A field meeting was held in August, 2001, between City staff, the College Gardens Civic Association (CGCA) and the Army Corps of Engineers and Maryland Department of Environment to get further direction from the state and federal regulators on the feasibility of obtaining wetland/waterway permits for an in-stream pond or ponds in the College Gardens tributary. The Corps of Engineers representative stated that an in-stream pond anywhere along the tributary downstream of Princeton Place is not a permittable option because there are practicable alternatives outside of the stream valley. The Maryland Department of the Environment representative concurred, stating that on-line or off-line SWM facilities in this tributary would create unnecessary natural resource impacts. Both regulatory agencies advised against further consideration of on-line or off-line SWM facilities along this tributary.

The Center prepared several alternative concepts for the proposed pond and analyzed costs, footprint size, and treatment capabilities. This work will be expanded in the future alternatives analysis discussed below.

Recommendations:

The changes proposed for College Gardens Park are of great concern to the residents. The project was discussed extensively in meetings with the Partnership members, other representatives of the College Gardens Civic Association and interested residents. The community asked that the City consider alternatives before committing to expanding the park pond, and the Mayor and Council agreed to this at the adoption of the watershed management plan.

Therefore, the City will have an engineering consultant team prepare an alternatives analysis for SWM options in the College Gardens sub-watershed, including evaluation of feasible options that might reduce the proposed pond's footprint in the park. After the CIP project funding for the College Gardens Park project is appropriated, the consultant will begin the alternatives analysis as the first step in the design for College Gardens SWM. This will allow a single design team to evaluate the options and comments from the community, staff and Mayor and Council before proceeding with final design of whatever alternative is chosen, resulting in greater continuity and efficiency for the project.

After initial data gathering, the City and the consultant will meet with interested people from the community, including representatives from College Gardens Civic Association and Montgomery County Public Schools (MCPS), to discuss concerns and explore options. The goal of the alternatives analysis will be to determine which watershed improvements provide the best balance between natural resource protection, park usage and safety concerns, community concerns, aesthetics, cost, and watershed protection for the College Gardens tributary. The consultant shall use available information from the Watts Branch Watershed Study and will provide additional engineering concept analysis of feasible proposals, as needed. It will be important for the City and the community to articulate realistic objectives early in the process.

The consultant's findings and recommendations will be circulated and discussed with those who have expressed interest or attended the initial meetings. After further discussion with the public, staff will present the benefits and constraints of each alternative, a summary of outstanding issues and recommendations to the Mayor and Council for their decision. DPW will then proceed with final design of the Mayor and Council's chosen alternative.

The consultant design team shall include a parks designer to address layout and safety issues in College Gardens Park. This site will need special coordination with the Department of Recreation and Parks (R&P) and the community since it is a heavily used park. The City Forester's request to move the pond's limit of disturbance further northward (to help preserve existing trees around the current dam) should be considered in the design stage. This will have to be balanced against community desires to maintain open space at the north end of the pond. R&P also has final authority over selection and design of any amenities or recreation opportunities in the park.

The design team will also coordinate with MCPS on park layout and obtain available plans for the College Gardens Elementary School expansion to use in the alternatives analysis and any final design within the park. The alternatives analysis and final design should address the following:

- Flexibility in SWM design, layout and size to help resolve residents' concerns while still meeting the watershed goals;
- SWM design details should promote safety, attractiveness and softening of the manmade structures visible in the ponds;
- Opportunities to reduce the SWM pond footprint will be explored;
- The park will be considered as a whole.

The proposed pond will necessitate relocation of the existing sand volleyball court and pavilion at the park. A non-regulation size sand court could be placed between College Parkway and the basketball court, if desired by the community, and the gazebo moved closer to the existing storage building. Currently, the Recreation Division uses College Gardens Park for a playground program in the summer, and believes that the pond will be compatible with programmed uses. The Recreation Division has asked that a pedestrian bridge spanning the forebay weir be included to improve circulation within the park. College Gardens Elementary School is slated for modernization by Montgomery County Public Schools (MCPS) in upcoming years. The modernization is expected to add a gym by taking ballfield area near the school. The City and MCPS expect that the active ballfield closest to College Garden Park will remain available for community and Recreation use.

The forebay, in particular, has been a source of concern for the community. The forebay provides the benefits of containing trash and sediment in one place within the pond, thus keeping the rest of the pond more attractive, and of creating a more irregular, pleasing shape to the pond's footprint. However, the forebay will take up open grassed area and the existing sand court. Staff and the consultants will re-examine the pond layout at the alternatives analysis stage to consider whether the pond could function adequately and be an attractive amenity without the forebay. Staff will evaluate all practical options, such as new cost-effective SWM technology, a different pond shape, a deeper pond, or using the College Gardens Office Park (SM-22) pond retrofit as a substitute for the College Gardens Park pond forebay.

The wooded condition of the existing pond's dam will need to be addressed in the design. Current dam safety requirements call for dams to be kept cleared of all trees and shrubs. Some members of the College Gardens Civic Association have requested that an expansion of the College Gardens Park pond move the dam southwest into the existing tot lot area, rather than preserving the dam and expanding the pond northeast into the play area around the sand court. However, the established trees around the dam are a valued feature to many other residents who have requested that the trees be preserved if at all possible. At the design stage, discussions should be held early in the process with the dam regulatory agency, the Natural Resources Conservation Service, to determine an acceptable redesign.

One option is to construct a new embankment with a full core trench upstream of the existing one. This might allow the trees on the older part of the dam to be safely retained if the new embankment has its own structural integrity. A bio-barrier or other impervious membrane would be introduced between the embankments to prevent root penetration of the new dam. The pond may need to be designed to maintain a Class 'A' dam rating to minimize dam breach hazards downstream. Also, the 100-year flood should be routed around the new pond to reduce unnecessary flows through the pond. The final landscaping plan should consider elements to improve the dam's appearance, such as ornamental plantings acceptable to the dam safety agency, boulders and more irregular grading of the top of the dam.

The proposed pond will be subject to federal and state permits from the regulatory agencies since it joins "Waters of the United States". The agencies have indicated that they will support the proposed College Gardens Park concept.
ID: SM-24
Name: Montgomery College Pond
Type: Wet Pond
Drainage Area = 123 acres

Concept: This existing wet pond, located on the Rockville Campus of Montgomery College next to Campus Drive West, would have minor modifications to the control structure to provide more effective release rates, although storage volume is very limited for both quality and quantity due to elevations of surrounding roads. Wetland plantings and/or an aerator or fountain would help improve water quality and pond appearance.

Advantages: simple, low-cost retrofit; no change to pond appearance or setting

Disadvantages: Private pond; only achieves 20% of necessary SWM control due to limited space

Recommendation: At this time, the City does not anticipate funding this private pond retrofit. However, the City will work with the college to facilitate this project. The College's Property Manager has expressed willingness to follow through on the retrofit. It should be noted that the downstream improvements will be marginal, given the limited effectiveness of this undersized pond. Some College Gardens Civic Association members felt strongly that any feasible SWM improvements in the college's pond should be achieved since the receiving tributary is important to their community.

ID: SD-6
Name: Woottons Mill Park
Type: Dry Pond with Micropool
Drainage Area = 38 acres

Concept: A new pond with two permanent pools would be added opposite Feather Rock Drive between the basketball court and the tot lot along a wooded, intermittent stream. The plan calls for a 4 foot deep forebay at the outfall of the existing storm drain from Hurley Avenue and a 3 foot deep micropool closer to the proposed dam. Both pools would be in the stream channel. This project would require clearing and regrading to create the area needed for temporary ponding, although the side slopes of the pond and the area between the forebay and micropool would be reforested.

Advantages: stabilizes the eroded stream channel at the site; achieves full water quality and partial water quantity control

Disadvantages: clears about 0.65 acres of forest; possible relocation of recreation facilities; limited value to downstream erosion protection; clearing may be visible from 4 houses

Recommendation: R&P recommended that this project be dropped because of the good condition of the drainage swale below the pond site. Currently, the channel where this pond would be sited has minor-moderate erosion between Hurley Avenue and the edge of the woods. Below this, the channel ends in a wetland area of reed canary grass; runoff flows through the grass about feet until it reaches the mainstem of Watts Branch. Since this grassed area is not currently experiencing erosion, the channel protection component of the SWM pond does not appear necessary at this time.

The pond would aid by providing water quality treatment for 38 acres of residential runoff. DPW recommends that the project remain in the management plan, but receive a low priority for implementation. If conditions change in the overbank area at Woottons Mill Park, or if the existing channel below the outfall continues to downcut, the pond may be needed to avoid erosion from this drainage area.

ID: SD-8
Name: Glenora Park
Type: Wet Pond
Drainage Area = 174 acres

(Total Drainage Area = 207 acres, including 33 acres treated through the Fallsgrove development)

Concept: This new pond is sited in the open space in Glenora Park opposite Glenora Lane and Balmoral Drive. Three large storm drains outfall into the head of the stream through the park. The concept calls for a permanent wet pond of up to 5 feet deep on the stream channel and extending east by excavating the adjacent grass field. The new dam would cross the stream at the existing pedestrian bridge and run parallel to the current tree line. The side slopes of the pond could be replanted with grass, shrubs or trees, although no trees are allowed on the dam. A tot lot next to the stream was replaced by R&P in Fall, 2000. If the SWM project is approved, the tot lot would be relocated to another site in Glenora Park, such as near the tennis courts, for safety reasons and to protect the tot lot from frequent flooding. For cost effectiveness, pond construction should coincide with the next projected replacement of the tot lot in ten years.

Advantages: achieves full water quantity and substantial water quality control; provides good erosion protection to severely eroded channels immediately downstream; avoids most of the adjacent stream valley forest in the park

Disadvantages: replaces large grass play area and requires relocation of nearby tot lot; clears about 0.3 acres of forest; clearing may be visible from 5 houses; requires relocation of a sewer line

Recommendations:

The Glenora Park pond is a key project for the Watts Branch management plan, both because of the relatively large drainage area it will control, and because it is needed to combat severe erosion downstream. The timing of this project must be coordinated closely with R&P and with local residents. Stream restoration ideally should be done concurrently or after upstream SWM controls are installed. The SWM allows less intrusive restoration techniques to be used, and helps protect the stabilization while the bank plantings take root. Currently, the Carter Hill Homeowners' Association's swimming pool property is threatened by erosion from the stream below Glenora Park. Although R&P has recommended that the pond be delayed until the onsite tot lot needs to be replaced, spot erosion problems downstream may need to be addressed earlier. Staff will continue to work with the Carter Hill HOA to help them obtain grants or other aid to deal with the erosion on their privately owned stream segment.

During the study, staff received limited input from local residents regarding this project; most of the concerns expressed related to safety and recreation availability for neighborhood children. Although this site is not used for programmed activities by R&P, it is heavily used by the neighborhood for informal recreation. The Glenora Park Civic Association was not represented at Partnership meetings, but several residents spoke at the Mayor and Council's Public Forum against the Glenora Park SWM project. They are concerned about loss of play area near Dundee Road, safety issues and appearance.

At the design stage, staff will work with the community and R&P to identify alternate recreation opportunities, such as an acceptable site within the park for the relocated tot lot. R&P has suggested that Glenora Park is fairly large and that the remaining space, including the ballfield, be considered

for regaining the passive recreational space, if necessary. The Director of Recreation and Parks compared this site to the Potomac Woods Park ballfield/SWM project, which adjusted the park layout to meet several goals. Landscaping choices should also be discussed with nearby residents.

This project will require state/federal permits. The wetland/waterway regulatory agencies suggest that the City re-align the outfall, if possible, to discharge into an offline swale before entering the stream channel. However, the extensive stream stabilization in this reach may make an in-stream outfall more appropriate since overbank area is limited at this point. The permitting agencies also asked that the City investigate maintaining a small baseflow in the section of abandoned stream channel between the dam and the pond outfall. This suggestion may be dropped by the agencies if little or no aquatic life is found within the upper stream reach; the abandoned channel is expected to revert to wetlands in either case.

ID: SD-12
Name: I-270 Interchange
Type: Dry Pond with Micropool
Drainage Area = 26 acres

Concept: This existing dry pond, located on State Highway Administration property between southbound I-270, eastbound Rte. 28 and the southbound I-270 on-ramp, would be modified to regrade the bottom of the pond to redirect flow through the established shallow marsh and change the control structure to provide the appropriate release rates. A trash rack would also be added to the riser.

Advantages: achieves full SWM control; simple, low-cost retrofit; no natural resources impacts

Disadvantages: none

Recommendations: This project is on Maryland State Highway Administration (MSHA) property, and will require consent & coordination through MSHA. A copy of the concept plan and computations was forwarded to MSHA in Fall, 2000, for review and comment, and a field meeting was held with MSHA representatives in Spring, 2001. City staff should work with MSHA to facilitate this project. Preliminary discussions with MSHA indicated that it would be low on MSHA's SWM retrofit priority list due to its size and the good condition of the existing riser. The City does not anticipate funding this project, but MSHA may have funding available through its SWM improvement program, or the City may obtain outside grant funding to implement it independantly. MSHA expressed willingness to grant permission for the retrofit if it was constructed by the City.

ID: SD-16
Name: Nelson Street
Type: Dry Pond with Micropool
Drainage Area = 37 acres
WITHDRAWN FROM FURTHER CONSIDERATION

A new pond was proposed for the State Highway Administration property between Nelson Street and I-270 opposite Beall Avenue. A dry pond with a small permanent pool would receive drainage from the existing storm drain outfall from Nelson Street. The pond was constrained by a water line and the mainstem of Watts Branch directly to the north and only 270 feet between Nelson Street and I-270. Since the pond could not be configured to fit the site without substantial forest clearing which would expose I-270 to the residents along Nelson Street, it would increase noise levels at the houses by about 10 decibels and also greatly alter the residents' views. A noise wall along the highway would mitigate the effects, but there was no way to guarantee this could be provided. Because this project would have such great disadvantages to nearby residents, the City staff, in consultation with the Partnership and the West End Civic Association, withdrew it from further consideration.

ID: SD-22
Name: Fordham Street
Type: Shallow Marsh
Drainage Area = 31 acres

WITHDRAWN FROM FURTHER CONSIDERATION

Concept: This new wetland marsh pond, located northwest of the intersection of Fordham Street and Princeton Place, is proposed on a wooded portion of Upper Watts Branch Park. The pond would be offline, fed by diverting frequent storms from the existing storm drain pipe which discharges into Watts Branch next to this site. A forebay of up to 3 feet deep and a micropool of 4 feet deep would be part of the permanent pool which will consist mostly of shallower (2-12" deep) water with aquatic plants and shrubs. Two small peninsulas are proposed to increase the flow length and add room for vegetation. Trees would be replanted on the eastern embankment, and the dam next to the existing trail and sewer line would be planted with grass or ground cover.

Advantages: expansion of existing wetlands and improved habitat; achieves full SWM control; would be partially surrounded by existing forest

Disadvantages: clears about 0.65 acres of forest; clearing may be visible from 7-9 houses; disturbs small area of existing wetland

Recommendations: This project was modified after discussions with an adjacent resident to move the limit of disturbance 50 feet away from the park's southern property line, thus leaving the existing storm drain and sewer rights-of-way undisturbed. The maintenance access path was also moved away from this residence. Notification for this project should include residents across the stream valley on Wintergreen Terrace.

This project would require state/federal wetland permits. The wetland/waterway regulatory agencies decided that, given the extensive springs in the pond area, this project is not permittable under current standards as designed. They recommended that the City investigate changing this into a small outfall treatment area for water quality only, and allow the majority of the runoff to stay in the existing storm drain pipe. A possible redesign was investigated to flow-split only the first flush into the existing wetlands, and create a 12-18" berm around them using coir fiber logs staked into place to avoid grading. A rip-rap outfall would conduct the overflow into the existing side tributary.

Since the new State SWM Manual prohibits release of untreated runoff to natural wetlands, the City would need a large manufactured water quality inlet at the flow-splitter for pre-treatment. This design was also rejected by MDE because it would change the hydrology conditions of the wetland and therefore staff withdrew the Fordham Street site from further consideration at this time.

ID: SD-24
Name: Calvert Road
Type: Dry Pond with Micropool
Drainage Area = 66 acres
(Total Drainage Area = 100 acres, including 24 acres treated through Rose Hill development)
WITHDRAWN FROM FURTHER CONSIDERATION

Concept: A new online SWM dry pond with two permanent pools separated by trees was proposed through a wooded area between Bullards Park and the Rockville Christian Church. The lower part of the pond would be graded to provide a 3 foot deep micropool and a dam that would be planted with grass or ground cover. Undisturbed woods would remain in the center of the pond, where temporary ponding would be held for up to 24 hours after storms. A small, 3 foot deep forebay would be located at the end of the existing 48" storm drain pipe at the head of the stream which flows through this area. The majority of this project is located on private land owned by the church, although a portion of the forebay would be on City-owned land. An access path would be cleared through both city and church property along the City's existing sanitary sewer line for construction and maintenance.

Advantages: stabilizes an eroded stream at the site; achieves full SWM control for the intended 66 acre drainage area

Disadvantages: mostly on private site – requires permission from church; clears about 0.8 acres of forest; clearing may be visible from 4 houses; Roxboro residents strongly opposed to any further tree clearing in vicinity, especially on City park land.

Recommendations: The Rockville Christian Church sent a letter on November 14, 2000, stating that the Church Board rejected committing its land for this project. Since the church was not able to grant permission at this time, the City withdrew this concept from further consideration due to lack of available land to carry out the project.

ID: O-3
Name: Welsh Park
Type: Dry Extended Detention with Micropool and Forebay
Drainage Area = 53 acres

Concept: This new pond would be sited in a wooded stream valley area upstream of the pedestrian path between Welsh Park's ball field and Beall Elementary School, northeast of Lynch Street. A micropool of up to 4 feet in depth would follow the existing eroded stream channel parallel to the path. A small, 3 foot deep forebay would be placed directly upstream. The existing embankment of the path would be raised 1 to 5 feet to provide the dam for the pond. A wetland area, consisting of an existing spring and its outflow channel, next to Beall Elementary School would remain undisturbed, and would drain directly into the pond's control structure.

Advantages: existing wetlands, pedestrian path and other recreational features would remain at Welsh Park; achieves full SWM control; adds wetland habitat to site; educational opportunity for adjacent Beall Elementary School schoolchildren and summer Recreation Services programs

Disadvantages: clears about 0.75 acres of forest; clearing may be visible to 3 houses; existing sanitary sewer must be relocated around edge of pond's permanent pool.

Recommendation:

This project was the subject of many inquiries during the summer Open House period. After gaining an understanding of the project, most people commented favorably and felt this pond would fit in with the character of the park. Frequently expressed concerns included a need for increased trash removal, maintenance of the existing paved path across the dam, and preserving the existing benches around the spring behind Beall Elementary School. The SWM project will be able to accommodate all of these issues. The Department of Recreation and Parks may also wish to locate a trash receptacle along this path since trash is an ongoing problem in this location, according to residents.

The Center performed a limited dam breach analysis to check that downstream houses would not be flooded in the event of a dam failure. The stream enters a 42" storm drain pipe just below the dam, and this pipe was determined to be adequate to handle a dam failure flood without inundating the houses. However, a nearby resident mentioned that the stream has occasionally overflowed into Lynch Street. Based on observations of current topography, today's overflow conditions may lead into Lynch Street rather than staying in the channel downstream of the existing pedestrian path. In the final design stage, after detailed topographic information is obtained, the consultant should perform a more detailed dam breach analysis and determine the flowpath. Some regrading and extension of the dam may alleviate this situation.

Beall Elementary School was also contacted about this project; the school staff's primary concern is for children's safety. In addition to standard safety features for this wetland marsh, staff should discuss the need for a fence with the school during the final design stage. The school may also wish to use the wetland marsh in educational programs or lessons.

This will require state/federal permits. The regulatory agencies recommended that the City redesign the pond to avoid the existing wetland; this revision was made and resulting in changing the concept from a shallow marsh system to a dry extended detention pond to achieve water quality treatment. The Army Corps of Engineers representative considers this revision to be approvable.

Table 3.6 Stormwater Management Concepts Summary Data

SWM Facility	Type of SWM Facility	Drainage Area (acres)	% Capture of Channel Protection Volume	% Capture of Water Quality Volume	Permanent Water Depth (Feet)	Temporary Water Depth (Feet) for 1-year storm	Surface Area at Top of Dam (acres)	Tree Loss (Acres) or Significant Trees (>8") Loss
Carnation Dr. – SM20	Dry pond w/ micropool & forebays	358	98%	37%	3'	10.1'	2.2	1.04
270 Industrial – SM18	Dry pond w/ micropool & forebay	322	95%	65%	3.5'	9.3'	2.3	1.06
College Gardens Park Pond – SM23	Wet pond w/ fringe marsh	84 (designed for 84 acres; 15 acres goes to SM22)	92%	70%	6.5'	12.6'	1.1	37 trees >8"
Welsh Park – O-3	Dry pond w/ micropool & forebay	53	100%	93%	4'	7'	0.83	1.1
Horizon Hills #1 – SM3 (upstream one)	Dry pond w/ fringe marsh micropool & forebays	88	100%	100%	4'	11.3'	1.0	15 trees >8"
Horizon Hills #2 – SM2 (middle one)	Dry pond w/ fringe marsh micropool & forebay	105 total (27 acres more than SM3)	100%	100%	4'	8.7'	1.5	6 trees >8"
Horizon Hills #3 – SM1 (downstream one)	Dry pond w/ fringe marsh micropool & forebay	185 total (80 acres more than SM2)	100%	100%	4'	9.2'	1.8	9 trees >8"
Woottons Mill – SD6	Dry pond w/ micropool & forebay	38	44%	100%	3'	7.1'	0.32	~0.65
Glenora Park – SD8	Wet pond w/ fringe marsh	207 (174 acres uncontrolled)	100%	80%	5'	13'	0.75	0.3 acres/20 trees >8"
Lakewood Country Club – SM9	Wet pond	46	100%	100%	5.5'	6.5	1.2	None
PEPCO Sevice Center Site – SM19	Dry pond w/ micropool & forebay	19	95%	76%	3'	7.6'	2.2	Not available

SWM Facility	Type of SWM Facility	Drainage Area (acres)	% Capture of Channel Protection Volume	% Capture of Water Quality Volume	Permanent Water Depth (Feet)	Temporary Water Depth (Feet) for 1-year storm	Surface Area at Top of Dam (acres)	Tree Loss (Acres) or Significant Trees (>8") Loss
College Gardens Office Park – SM22	Wet pond	15	100%	100%	4.7'	7.5'	0.84	None
Montgomery College Pond – SM24	Wet pond	123	30%	20%	5.7	8.5	1.5	None
I-270 Interchange – SD12	Dry pond w/ micropool & forebays	26	100%	100%	Not available	Not available	0.4	Not available

Detailed concept design drawings of the 18 sites were prepared as part of the Phase II tasks. The plans and supporting calculations contained information such as plan and profile of proposed retrofit, control structure and pipe sizes, limits of disturbance, construction and maintenance access, utility protection/relocation (if necessary), impacts to natural resources, dam breach potential (where applicable), and an estimate of number of trees to be removed. The design information was presented to the Watts Branch Partnership at several meetings and displayed at the two open houses by the City. Due to the size of the plans, they are not included in this report; however, the City maintains copies of the relevant information[2].

As noted above, after presenting and discussing the 18 candidate retrofit site concept designs, three of the sites were ultimately dropped from consideration due to objections from regulatory agencies, the public or other logistical problems (e.g., property ownership, permitting constraints). The three sites that were removed from further consideration included SD-24 (Calvert Street), SD-22 (Fordham Street), and SD-16 (Nelson Street). In addition, one site, SM-8 (Aintree Pond), is being improved at this time outside the watershed study process. This results in 14 sites as priority implementation projects for the watershed study.

The retrofit ranking system is one of two elements that was used to make decisions about which potential retrofit projects should be investigated further within the overall watershed management plan. The second element evaluates the highest scoring sites on a subwatershed basis to help define the specific subwatersheds of Watts Branch that should be the priority for implementation. This is effectively a watershed management ranking approach which is more subjective in nature but reflects the real world issues associated with getting projects approved and constructed in a cost effective manner. This ranking process requires consideration of factors such as which projects will be the least disruptive to the public, which projects can work within the constraints of the capital improvement projects budget, and which projects can be linked together to provide design and construction economies of scale. This important project management ranking element is described in Section 5, where retrofit recommendations are outlined for consideration in the final watershed management plan for Watts Branch.

3.6 Hydrologic Modeling Assessment of Priority Retrofit Sites

As previously described in Section 2.3, a hydrologic analysis using the NRCS model, TR-20 was conducted to assess the effect that the proposed priority stormwater retrofits will have on the peak discharges at several design points in the watershed. Figure 3.2 shows the priority retrofit sites with their associated contributing drainage areas. The assessment was performed considering both existing and ultimate build-out conditions in the watershed.

Existing Development Condition with Existing and Proposed Structures
With this model run, it will be able to assess the effectiveness of proposed structures on the stream system, when compared to previous model runs (Section 2.3). Table 3.7 shows the peak discharges

[2]There are several pieces of project support information that have not been included in this Watershed Study document, but are still part of the project record maintained by the City. Appendix F provides a list of such information.

for each of the ten historic cross sections and at other selected locations within the watershed.

Table 3.7 Peak Discharges – Existing Condition with Existing and Proposed Structures

Return Period	6 Month	1 Yr	18 Month	2 Yr	10 Yr	100 Yr	
24 Hour Rainfall	1.7"	2.6"	3.0"	3.2"	5.1"	7.2"	
Location	Qp-cfs	Qp-cfs	Qp-cfs	Qp-cfs	Qp-cfs	Qp-cfs	TR-20 Reference (Area Sq. Mi.)
Cross Section 1	6.40	19.44	44.34	76.99	593.69	1163.21	Struct 2 Resvor (.54)
Cross Section 2	12.37	41.75	78.25	99.15	304.49	506.89	Struct 7 Addhyd (.26)
Cross Section 3	18.60	66.26	97.96	147.28	1035.36	1790.33	Struct 6 Addhyd (1.32)
Cross Section 4 & 5	102.63	350.34	476.92	544.45	1164.39	2039.36	Struct 14 Addhyd (2.40)
Cross Section 6	118.01	389.02	487.30	550.49	1158.14	1984.44	Struct 17 Resvor (2.50)
MD Route 28	90.66	348.35	458.43	516.83	1147.46	1855.92	Struct 18 Resvor (2.50)
Cross Section 7 & 8	96.53	338.67	514.33	629.28	1865.30	3410.29	Struct 32 Addhyd (3.82)
Hurley Avenue	2.07	14.06	31.81	45.26	238.94	448.31	Struct 39 Resvor (0.32)
Cross Section 9	102.86	370.39	550.43	689.63	2204.02	4003.19	Struct 43 Addhyd (4.43)
Cross Section 10	103.46	372.85	552.60	691.75	2211.15	4010.66	Struct 43 Addhyd (4.45)
City Boundary	132.46	462.45	690.95	794.5	2354.04	4216.63	Struct 70 Addhyd (6.46)

Ultimate Development Condition with Existing and Proposed Structures

Table 3.8 shows the peak existing development discharges for each of the ten historic cross sections and at other selected locations within the watershed.

Table 3.8 Peak Discharges – Ultimate Condition with Existing and Proposed Structures

Return Period	6 Month	1 Yr	18 Month	2 Yr	10 Yr	100 Yr	
24 Hour Rainfall	1.7"	2.6"	3.0"	3.2"	5.1"	7.2"	
Location	Qp-cfs	Qp-cfs	Qp-cfs	Qp-cfs	Qp-cfs	Qp-cfs	TR-20 Reference (Area Sq. Mi.)
Cross Section 1	9.09	80.79	188.63	261.30	741.30	1325.89	Struct 2 Resvor (.55)
Cross Section 2	43.10	129.37	175.92	200.15	402.49	610.37	Struct 6 Runoff (.25)
Cross Section 3	29.31	121.15	264.83	362.78	1199.80	1915.56	Struct 6 Addhyd (1.33)
Cross Section 4 & 5	139.95	400.51	543.33	618.16	1323.38	2157.80	Struct 14 Addhyd (2.41)
Cross Section 6	153.16	422.33	542.08	613.41	1333.61	2073.07	Struct 17 Resvor (2.52)
MD Route 28	120.06	395.76	514.94	579.39	1317.37	1988.57	Struct 18 Resvor (2.52)
Cross Section 7 & 8	223.47	659.78	897.87	1022.87	2295.75	3767.39	Struct 32 Addhyd (3.83)
Hurley Avenue	2.94	17.04	38.95	54.10	285.46	519.12	Struct 39 Resvor (0.32)
Cross Section 9	229.81	683.48	939.81	1088.32	2650.13	4288.30	Struct 43 Addhyd (4.45)
Cross Section 10	230.40	685.16	942.29	1091.28	2657.27	4295.80	Struct 43 Addhyd (4.47)
City Boundary	242.96	713.20	981.88	1123.57	2778.47	4479.06	Struct 70 Addhyd (6.46)

Figure 3.2 Priority Retrofit Sites with Associated Drainage Areas